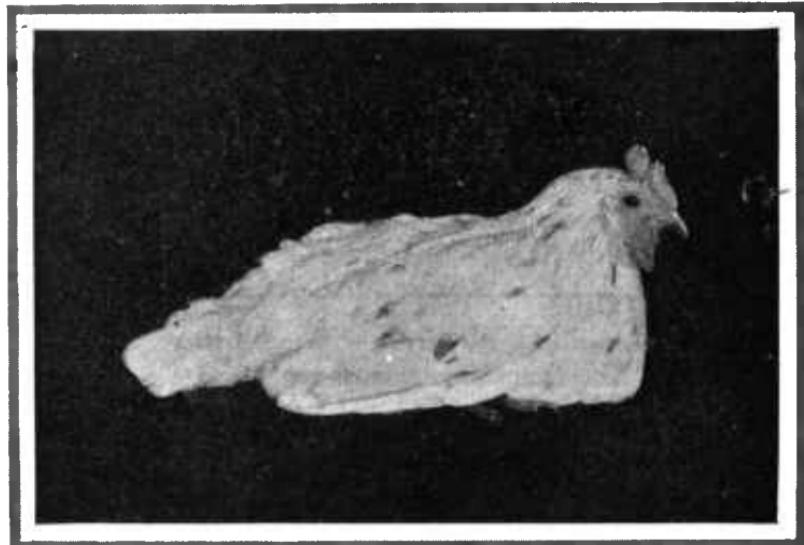


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TUBERCULOSIS OF FOWLS

BERNARD A. GALLAGHER
Pathological Division



A tuberculous fowl—an advanced case.

FARMERS' BULLETIN 1200
UNITED STATES DEPARTMENT OF AGRICULTURE

TUBERCULOSIS OF FOWLS is widely distributed over the United States.

It is especially destructive to flocks in the North and West.

The course of the disease is slow, symptoms are apparent only in the late stages, and the mortality is high.

Characteristic lesions are found in the internal organs of affected fowls, and are easily recognized.

Treatment of affected fowls is useless, but the disease may be stamped out by methods which are given in this publication.

Contribution from the Bureau of Animal Industry

JOHN R. MOHLER, Chief

Washington, D. C.

Issued June, 1921

TUBERCULOSIS OF FOWLS.

CONTENTS.

Page.		Page.	
Occurrence of the disease.....	3	Post-mortem appearance.....	6
Cause of tuberculosis	3	Telling tuberculosis from other diseases.....	8
How birds become infected.....	4	Testing for tuberculosis.....	9
Symptoms.....	5	Prevention.....	9

OCCURRENCE OF THE DISEASE.

TUBERCULOSIS OF FOWLS is a chronic, infectious disease characterized by the formation of tubercles or nodules, and resembling tuberculosis of other animals and man. It is commonly called spotted liver, liver complaint, or rheumatism. Affected birds are also described as "going light."

The disease has been observed in many species of birds, among which may be mentioned the fowl, turkey, pigeon, duck, goose, guinea fowl, peafowl, ostrich, parrot, canary, pheasant, sparrow, and swan. Among wild birds it is most destructive to those confined in zoological gardens.

Of domesticated birds the fowl shows by far the highest mortality from tuberculosis. The disease is known to prevail in many countries and is widely distributed in the United States. It has spread so extensively in some States as to cause very serious losses to the poultry industry.

The insidious manner of attack makes tuberculosis most difficult to combat, because in affected birds there are no visible symptoms until the disease processes are far advanced, and in the meantime the bird may be spreading the disease among others of the flock.

CAUSE OF TUBERCULOSIS.

Tuberculosis of fowls, known also as avian tuberculosis, is caused by the *Bacillus tuberculosis avium*, a microorganism which closely resembles the bacilli of human and bovine tuberculosis. While the avian tubercle bacillus primarily affects birds, it may also attack other animals. Pigs exposed to tuberculous flocks frequently become infected and display localized tubercles in the lymph glands of the head, neck, and mesentery. Rats and mice may also contract the disease naturally. Avian tuberculosis has been produced experimentally by feeding or inoculation in pigs, calves, colts, goats, rabbits,

guinea pigs, monkeys, rats, and mice. Bacilli of the avian type have been found on several occasions in tuberculous persons. The danger to man, however, is very slight, especially since cooking the flesh of fowls destroys the bacilli. The principal danger would be the eating of raw eggs from tuberculous fowls; but as eggs are only occasionally infected, and as man is naturally highly resistant to the avian type of tubercle bacilli, the chances of the development of infection are considered slight. From a hygienic standpoint only birds, pigs, rats, and mice occupy a significant position in natural susceptibility to avian tuberculosis.

Birds have been infected artificially with mammalian types of tubercle bacilli; but with the exception of parrots and canaries, which are quite susceptible, birds are strongly resistant to human and bovine types of tubercle bacilli through natural channels of infection.

HOW BIRDS BECOME INFECTED.

The tubercle bacilli enter the fowl's body through the mouth and pass into the alimentary tract. They are picked up in drinking and feeding, and through the bird's eating of the carcass of another fowl that died of tuberculosis. The organisms pass from the intestinal canal into the wall of the intestine and are carried to the liver with the food material absorbed in the intestine. Their passage from the liver to other organs is principally by means of the blood stream.

Tubercle bacilli may be introduced on a farm or poultry establishment in a number of ways. Among these are the addition to the flock of fowls from an infected flock, exposure to a neighboring infected flock ranging over the same ground, infection of the premises by free flying birds, especially pigeons from infected flocks, and carriers, such as man or animals, whose shoes or feet may carry infected droppings from a near-by farm. Tubercle bacilli are sometimes found in eggs from tuberculous fowls and there is a possibility of introducing infection in eggs obtained for hatching. However, most eggs that harbor this organism fail to hatch, and thereby reduce to a minimum the chances of infection by this means. If such infected eggs are thrown to the chickens, however, the disease may become established in the flock.

Once avian tuberculosis is introduced on a premises it spreads slowly but persistently, until by the time its presence becomes apparent a large percentage of the flock may be affected, although only a few birds may show symptoms and deaths occur only at intervals. The extent to which affected birds spread infection depends upon the stage the lesions have reached in individuals. The outlet for the tuberculous organisms is principally through the intestinal canal by means of the droppings. The bacilli are given off in great numbers from the ulcerated areas in the intestinal wall and from the nodules

on the intestine which open into the intestinal canal through small channels. It is also probable that bacilli may pass from the liver through the bile ducts.

In the earlier stages of disease the organisms are held back by the protective wall of the nodules, but when extensive tubercles are formed by successive infections or by spread of the infection through the system, these nodules are broken down, and the inclosed masses of bacilli which continue to multiply in the nodules are released. Therefore it is the older fowls which have harbored tuberculosis for months, or even one or two years and are badly diseased, which give off infection to the greatest degree, and hence are the most dangerous to uninfected birds.

The disease-laden droppings contaminate the floors of the houses, the ground, and feeding and drinking vessels. The organisms thus spread are readily picked up by healthy fowls in feeding and drinking, and in the course of time practically the entire flock may be affected. Individual birds show varying degrees of resistance, however, and in some tuberculous flocks a few birds may remain free of disease or show only minor lesions. As a rule, though, if exposure is great, infection is equally extensive and the mortality is high.

SYMPTOMS.

Although the birds may become infected at any age, the disease is not readily detected by ordinary observation in those under 1 year old, owing to the fact that a number of months are required for the tubercle bacilli in the system to multiply sufficiently to interfere in a marked degree with the normal functions of the body. Hence it is the older fowls, those from 2 to 3 years old, which are most likely to display noticeable symptoms of disease and show a high death rate.

One of the first symptoms exhibited is gradual emaciation, which becomes especially noticeable in the breast muscles. These diminish in size until in advanced cases there is scarcely any flesh left on the breastbone. Feeling the breast region with the fingers will readily detect this wasting of the muscles. Loss of weight proceeds with emaciation and is very marked in the late stages of the disease. The appetite continues good. There is no rise in temperature, a normal range of from 106° to 108° F. being maintained until shortly before death, when the temperature drops several degrees.

Lameness in one or both legs, or drooping of one or both wings, is often observed, and may be the first symptom seen. These result from the development in joints of the legs or wings of tubercle bacilli, which cause painful swellings. The swellings may break down and discharge a cheesy material.

As the disease advances, the comb, wattles, skin of the head, and membranes in the mouth and about the eyes become pale. The eye

itself remains bright. The feathers are ruffed. The bird grows listless, weak, moves about little and is easily caught. Diarrhea, with greenish or yellowish droppings, leads to complete exhaustion.

Deaths in the flock occur at intervals. Affected birds may live only a short time after symptoms are noticed, or they may live for weeks. This depends to a large extent on the stage reached by the disease before the attention of the owner is attracted to the condition of the fowl. The course of tuberculosis is indefinite, however, and may be shorter in flocks where infection is widespread and consequently heavier than in mildly or newly infected flocks. Its course may run well over a year from the time the individual is infected.

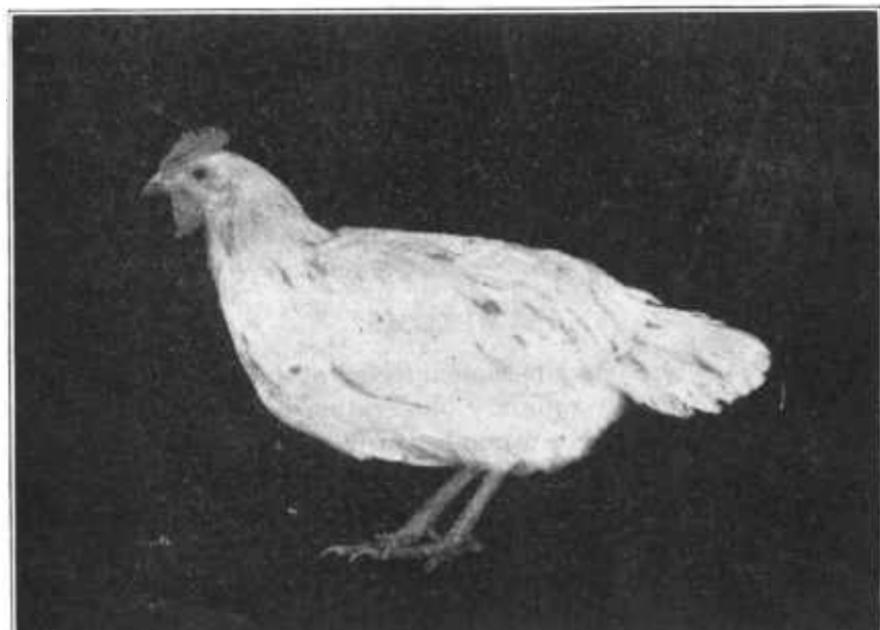


FIG. 1.—Tuberculous fowl, showing paleness of the head, ruffed feathers, swelling of the joints of the feet, and weakness. Advanced stage of the disease.

POST-MORTEM APPEARANCE.

Tuberculosis in fowls is manifested internally by tumors or tubercles in various parts of the body. These tubercles represent an attempt on the part of the bird's protective forces to wall off the invading microorganism and prevent its multiplication and spread throughout the system. The tuberculous lesions are primarily associated with the digestive system, and secondarily with other organs of the abdominal cavity, and body tissues. The lungs are not affected to the extent observed in tuberculosis of mammals.

The organs most frequently involved stand approximately in the following order: Liver, spleen, intestines, lungs, bones, joints, peritoneum, kidneys, and ovary. Lymphatic glands are few in birds and

therefore do not command the importance attached to them, in tuberculosis of other animals.

The liver of an affected bird nearly always shows extensive lesions. The nodules are of varying sizes, the smaller ones having a white or grayish-white color, while the larger, more advanced ones assume a yellowish tinge. These tubercles are readily observed on the surface of the liver, and when the latter is sliced are also seen to be numerous in the interior. Extensive degenerated areas may be present. The liver is usually enlarged, sometimes to a marked degree. It may be pale in color and easily torn when handled. Not infrequently tuberculous fowls die from internal hemorrhage as a result of rupture of the degenerated liver.

The spleen is affected almost as often as the liver and presents much the same diseased appearance. It also is greatly enlarged, in



FIG. 2.—Internal organs of fowl showing typical tuberculous lesions on
(a) liver, (b) intestine, (c) gizzard, and (d) heart.

many cases, even more so in proportion to its normal size than the liver.

Varying sizes of tubercles are distributed over the intestine, giving it at times a knotty surface. Nodules occur in the mucous membrane, deep in the wall of the intestine, and in the membrane which supports it. The lesions in the mucous membrane are often ulcerated, while the deeper ones frequently open into the intestinal canal through short channels and discharge enormous numbers of tubercle bacilli. The nodules ordinarily range in size from a pinhead to a pea, but may grow to an inch in diameter. They are firm to the touch and grayish white or yellowish in color.

Tuberculous changes are observed irregularly in the lungs, bones, and joints, peritoneum, kidneys, ovary, and other organs or parts. Usually one or more of the organs mentioned show lesions in individual cases, and each is affected in from 10 to 30 per cent of all cases. The tubercles are similar to those previously described. They tend to remain isolated and are easily separated from the tissues. Bone lesions are found principally at the joints. These show swelling, erosions, and accumulation of cheesy material.

Avian tubercles when cut open present a solid, grayish, glistening interior which in the larger ones exhibits yellowish centers or a number of yellowish points. Those of more advanced growth show extensive yellowish, cheesy, or crumbly masses in their interior, but do not develop into the gritty state familiar in mammalian tuberculosis.

TELLING TUBERCULOSIS FROM OTHER DISEASES.

The diseases which may be confused with tuberculosis of birds by similarity of lesions are: Tumors or cancers of the abdominal organs, tapeworm nodules in the intestine, fungous condition of the lungs, blackhead of turkeys, blood poisoning which produces an enlarged, spotted liver or gouty swellings of the joints. These diseases will not be considered in detail here since they are described in Farmers' Bulletin 957, a copy of which may be had on request. In general it may be said that the prominent lesions of the conditions mentioned are usually limited to certain specific organs instead of being spread to the variety of organs attacked in tuberculosis.

Tumors may be found in various parts of the body, but are usually few in number and considerably larger than tuberculous nodules. They generally contain blood vessels, while tuberculous growths are free from them. Tumors often degenerate and present dead, bloody areas.

Tapeworm nodules are confined to the intestinal wall and, as the description indicates, are caused by tapeworms in the intestine.

Nodules of fungous origin are found in the lungs and air sacs and only occasionally spread to other organs by immediate contact.

They are caused by certain molds and often are associated with a greenish growth in the air passages.

In blackhead of turkeys the liver and the ceca, or blind pouches of the intestine, are affected. The liver lesions are yellowish or greenish in color, but do not show the characteristic tubercle formation of tuberculosis.

Blood-poisoning diseases may produce yellow, decaying areas in the liver and spleen, accompanied with enlargements of these organs. There is, however, no nodular formation; the intestine is usually inflamed, and the heart may show hemorrhages on its wall.

In gout the joints may be swollen with pronounced lameness but without internal lesions resembling tuberculosis.

A definite diagnosis may be had in all cases by microscopic examination of the disease processes. Avian tubercles contain extremely numerous tuberculosis organisms which are readily seen in a laboratory examination.

TESTING FOWLS FOR TUBERCULOSIS.

Diagnosing tuberculosis in living fowls is possible by means of the intradermic tuberculin test. The test fluid used is prepared from bouillon in which avian-tubercle bacilli have grown for several weeks. The fluid must be injected, by means of a small-caliber syringe with a 26 or 27 gauge needle, into the deeper layer of the skin of the wattle or comb. It is preferable to inject both wattle and comb for greater accuracy. Slightly less than one drop, about one-twentieth of a cubic centimeter, is forced into the skin just beneath the surface, and not deep enough to penetrate the skin into the underlying connective tissue of the wattle or comb. Only one wattle is injected, the other being left for comparison. At the end of 48 hours following injection, a swelling in the wattle or comb indicates a positive reaction and the presence of tuberculosis in the fowl. A high percentage of tuberculous fowls in a flock may be detected by this test, but much of its success depends on the skill of the operator in placing the tuberculin properly within the skin tissues and in observing the results. Practice in the operation increases the efficiency of the test.

PREVENTION.

Medical treatment of tuberculosis in fowls is futile; hence measures for combating the disease must be of a preventive nature. The most thorough method of eradication is to slaughter the entire flock when indications point to an extensive outbreak. Fowls in good flesh, showing no lesions or slight ones, may be used for food. Those badly diseased and all visceral organs should be destroyed.

The chicken houses, inclosed runs, and all eating, drinking, and other utensils should be thoroughly cleaned and disinfected with

a strong solution of such germicides as carbolic acid, cresol, bichlorid of mercury, formaldehyde, or any of the recognized coal-tar preparations or dips. Carbolic acid may be used in 5 per cent solution, compound cresol in 3 per cent solution, bichlorid of mercury in a solution of 1 part to 500 parts of water, and formaldehyde in the proportion of 1 part of commercial formalin to 10 parts of water. Ordinary quicklime is a good, cheap disinfectant for poultry yards.

In disinfecting houses or yards merely sprinkling the germicide here and there is of little value. The liquids should be sprayed or otherwise applied in a thorough manner, so that the area to be disinfected is well soaked. After disinfection the premises should be kept free of fowls for several months, or a year if possible, so that any germs not reached by the disinfectant may die. If convenient it is advisable to place new stock on ground which has not been occupied by poultry for a year or more. The sun's rays will destroy organisms exposed to them in a short time, and by this means fields and yards are disinfected to a large extent. There are many dark or covered places not reached by the direct rays of the sun, however, and in such spots the germs of tuberculosis may survive for several months.

It is highly important in restocking to obtain fowls, or eggs for hatching, from flocks which have shown no evidence of the presence of an infectious disease for at least a year. Also, as a general principle when introducing fowls into a healthy flock, the new birds should be quarantined for at least a month in order to give time for the development of symptoms of any of the more acute diseases which may be carried.

When the breeding value of the fowls or other interests make it undesirable to dispose of the entire flock, tuberculosis may be controlled and even eradicated by other measures if consistently practiced. As has been stated, the disease develops very slowly as a rule and affected birds do not spread the bacilli in the droppings until the internal lesions are far advanced. Fowls more than 2 years old show the highest per cent of infection and the most advanced lesions and they are most dangerous as spreaders of tuberculosis. For this reason it is advisable to dispose of all birds when they reach the age of 2 years, or at the end of the second laying period. From an economic standpoint also this is sound policy, as the egg yield decreases after the second year of laying. Younger birds should be disposed of whenever they appear to be abnormal. This procedure alone will go a long way in holding tuberculosis in check, and will keep the losses to a minimum, although it may not be depended on to eradicate the disease completely.

Much more effective control or complete eradication may result by supplementing the culling measures with the tuberculin test already described. While this test can not be depended upon to

detect every tuberculous fowl, the large percentage which may be detected by its skillful application warrants its use as an important aid in eradication measures. After a period of several months the flock should be tested again in order to discover new cases of tuberculosis, or cases which failed to react to the first test. The percentage of reactors to the second test should be very small. All birds showing positive or doubtful reactions should be disposed of after each test.

Diseased carcasses should never be thrown where chickens can pick at them, as there is much greater danger of severe infection from eating the tuberculous organs of a dead fowl than from other sources. Neither should carcasses be thrown to hogs, as those animals are susceptible to avian tuberculosis. All carcasses should be burned or buried deep.

Since rats and mice may contract avian tuberculosis they may have an influence on the spread of infection caused by fowls eating the carcasses of rats dead of the disease. The destruction of rats and mice guards against this avenue of infection.

